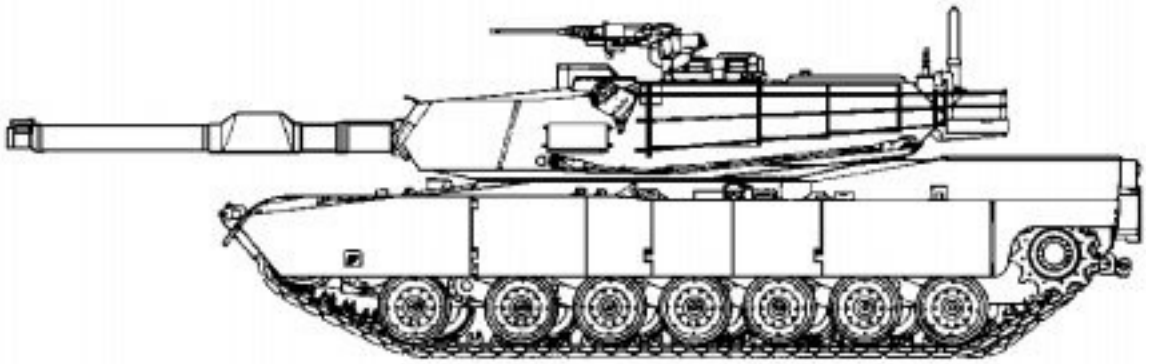
1ST INFANTRY DIVISION

MAIT TEAM

M1 ABRAMS SERIES

ULM TRAINING

INSTRUCTOR: SFC SHEPHARD



The M1A1 Abram Main Battle Tank is the principal tank of the United States Army. Originally developed in 1983. It’s characteristic low profile and angular appearance set it apart from other Tanks. The M1’s four-man crew is protected by ‘Cobham’ armored on glacis and turret, armored bulkheads between turret and engine, blow out panels over the main gun ammunition compartment and an effective fire-suppression system.

Specifications

Weight (pounds) 67.5 tons	Length 32’4”
Width 12'	Height 9'6"
Forward speed 42 mph	Reverse speed 25 mph
Engine 1500 hp AGT-1500C Turbine	Vertical. 49 in
Max.width ditch 108 in	Fording Depth 48 in

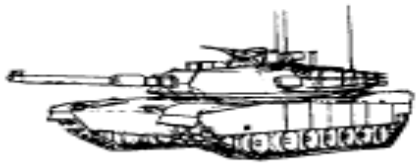
The M1A1/2 Abrams main battle tank is manufactured by General Dynamics Land Systems (GDLS). The first M1 tank was produced in 1978, the M1A1 in 1985 and the M1A2 in 1986. 3,273 M1 tanks were produced for the US Army. 4,796 M1A1 tanks were built for the US Army, 221 for the US Marines and 555 co-produced with Egypt. Egypt has ordered a further 200 M1A1 tanks with production to continue to 2005. 77 M1A2 tanks have been built for the US Army, 315 for Saudi Arabia and 218 for Kuwait. For the M1A2 Upgrade Program, over 600 M1 Abrams tanks are being upgraded to M1A2 configuration

Supersedes copies dated 30 December 1985, including all changes; see page i for details.

OPERATOR'S MANUAL

OPERATOR CONTROLS, PMCS, AND OPERATION UNDER USUAL CONDITIONS

VOLUME 1 OF 2



TANK, COMBAT, FULL-TRACKED: 120-MM GUN, M1A1 2350-01-087-1095 GENERAL ABRAMS

VOLUME 1

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HEADQUARTERS, DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. MARINE CORPS

25 SEPTEMBER 1990

WARNING

RADIATION HAZARD

Safety Precautions

1. **Tritium** (H3): a. Fire control devices contain luminescent phosphor activated by radioactive tritium gas sealed in glass capsules. c. Maintenance and indoor storage areas are to be well ventilated and surveyed quarterly by LRPO to monitor for tritium contamination. Limit indoor storage to 1000 curies per separate room. Ensure workbenches are covered with absorbent paper (e.g., kraft paper) and spare parts in the maintenance area kept to a minimum. Additional safety precautions and emergency procedures are in TM 9-254, General Maintenance

Procedures for Fire Control Materiel.

2. **Thorium** (Th232): a. The anti-reflective coating on all thermal optics in the gunners primary sight are coated with thorium fluoride (ThF4) which is slightly radioactive. The only potential hazard involves ingestion or inhalation of this coating material. Dispose of broken lenses IAW AR 385-11. b. The M1 series tank contains a turbine engine combustor liner. The liner is a metallic alloy composed of thorium 232 evenly dispersed in nickel. If the liner breaks or melts, call your LRPO. In coordination with LRPO, bag liner and all pieces. LRPO will notify TACOM NICP for disposition instructions. Disposal is not authorized below depot level. Unserviceable combustor liners will be disposed of as radioactive waste or sent to a licensed thorium rework facility in the Army. The combustor liner is a non-repairable component. The only maintenance function allowed is replacement with a new one. Combustor liners separated from vehicle engines will be tagged/labeled with the words "Radioactive Material.

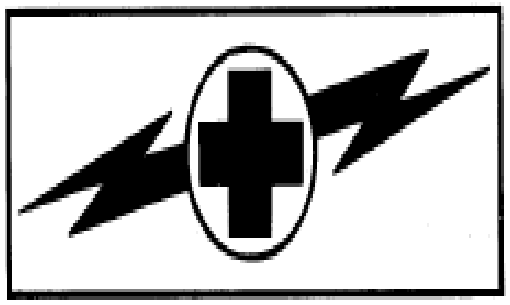
3. **Depleted Uranium** (DU or U238): DU is a metal used in munitions and M1A1/M1A2 ta armor because of its high density. Damage or fire to the DU munitions/armor may result i contaminated smoke, ash or dust (refer to TB 9-1300-278). DU is an internal health hazar if inhaled, ingested, or embedded in skin. It presents both radiological and toxicological effects. If handling bare metal is necessary, gloves must be worn.

4. **Engine Spark Igniters**: The engines of the M1 series tank contain engine igniters tha have nickel 63, cesium 137 and krypton 85 radioactive materials. Hazards exist with thes items when they are broken open or when they are stored in bulk quantities.

WARNING

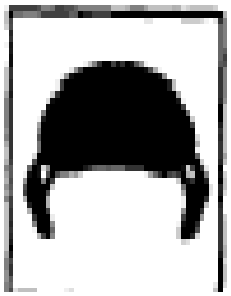
You can be blinded if you look into a laser beam when you are not wearing industrial goggles. Never aim the laser rangefinder (LR) at personnel. If the laser beam reflects from a flat, mirror-like surface it can blind you unless you are wearing industrial goggles. All personnel who work down range of the laser must wear industrial goggles. Industrial goggles, NSN 4240-00-258-2054, or an approved substitute, will protect you. Treat the laser rangefinder as a direct-fire weapon, with hazardous range of 8000 meters (8752 yd).

GUN/TURRET MOVEMENT



HIGH VOLTAGE

CARBON MONOXIDE (EXHAUST GAS) CAN KILL YOU



SINGLE HEARING PROTECTION REQUIRED
DOUBLE HEARING PROTECTION REQUIRED

WARNING

SECTION II. PREVENTIVE MAINTENANCE

CHECKS AND SERVICES (PMCS)

GENERAL

Preventive maintenance checks and services (PMCS) are performed to keep the tank in operating condition. The checks are to find, correct or report problems. Crewmembers are to do the PMCS jobs as shown in table

2-1. Daily PMCS are done every day the tank is operated, using table 2-1.

Before you begin operating tank equipment, do BEFORE (B) PMCS. Pay attention to WARNING and CAUTION statements. A WARNING means someone could be hurt. A CAUTION means equipment could be damaged.

During operation, do DURING (D) PMCS.

After operation, do AFTER (A) PMCS. Remember to read WARNING and CAUTION statements.

Once a week do WEEKLY (W) PMCS. If tank has not been operated in a week, also do (B) PMCS at the same time.

Do MONTHLY (M) PMCS once a month. if tank has not been operated in a month, also do (A) PMCS at the same time.

If you are operating the tank for the first time, do your (W) and (M) PMCS the first time you do your (B) PMCS.

If you find something wrong when performing PMCS, fix it if you can, using Chapter 3 troubleshooting and maintenance procedures.

The right-hand column of the PMCS table lists conditions that make the tank not ready or not available for readiness reporting. The terms "ready/available" and "mission capable" refer to the same status -equipment is on hand and is able to perform its combat missions. Use DA Form 2404 to list faults you cannot fix and faults

corrected by replacing pans. For further information on how to use this form, see DA PAM 738-750.

If tools required to perform PMCS are not listed in Appendix B, notify unit maintenance.

NOTE

Numbers in the locator view at the top of the page match the item numbers in the left-hand column of the table.

LEAKAGE DEFINITIONS

It is necessary to know how fluid leakage affects the status of the tank. The following are definitions of the classes of leakage an operator or crewmember needs to know to be able to determine the condition of a leak.

Learn, then be familiar with them, and REMEMBER -WHEN IN DOUBT, ASK YOUR SUPERVISOR.

Leakage Definitions for Crew/Operator PMCS

CLASS I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II Leakage of fluid great enough to form drops but not enough to cause drops to drip from item being checked.

CAUTION

· Equipment operation is allowable with minor leakages (Class I or II) except for fuel leaks. Of course, consideration must be given to the fluid capacity of the Item or system being checked. When in doubt, ask your supervisor.

· When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS.

· Class III leaks should be reported on DA Form 2404 for corrective action by unit maintenance.

INSPECTION

Look for any sign of a problem or trouble. Senses help here. You can feel, smell, hear, or see many problems.

Be alert when on the tank.

Inspect to see if items are in good condition. Are they correctly assembled, stowed, secured, excessively worn, leaking, corroded, or properly lubricated? Correct any problems found or notify unit maintenance.

There are some common items to check all over the tank. These include the following:

Bolts, clamps, nuts, and screws:

Continuously check for looseness. Look for chipped paint, bare metal, rust, or corrosion around bolt and screw heads and nuts. Tighten them when you find them loose. If tools are not available, notify unit maintenance.

Welds:

Many items on the tank are welded. To check these welds, look for chipped paint, rust corrosion, or gaps. When these conditions exist notify unit maintenance on DA Form 2404.

Electrical wires, connectors, and harnesses:

Tighten loose connectors. Look for cracked or broken insulation, bare wires, and broken connectors.

If any are found, notify unit maintenance.

Hoses and fluid lines:

Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots mean a leak; a stain by a fitting or connector can also mean a leak. When you find a leak, notify unit maintenance.

CLEANING AND LUBRICATION

Proper cleaning and lubrication can aid in avoiding possible problems or trouble, so make it a habit to do the following:

CAUTION

Carefully follow all cleaning and lubricating instructions. Failure to doso can result in damage to equipment.

1. Expose canvas covers and tarpaulins to fresh air during semiannual service. Reduce interval as required in a rainy climate. Do not stow canvas items when wet.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. To avoid injury, wear protective gloves and goggles and use only in a well ventilated area. Avoid contact with skin, eyes, and clothes and don't breathe vapors. Do not use near open fire or excessive heat. The flashpoint for Type I dry cleaning solvent is 100°F (38°C) and for Type II is 140°F (60° C). If you become dizzy while using dry cleaning solvent get fresh air immediately and get medical aid. If contact with eyes is made, wash eyes with water and get medical aid immediately.

2. Use dry cleaning solvent (Item 38, Appendix D) and clean rag (Item 36, Appendix D) to clean grease or oil from all metal surfaces except those exposed to powder fouling.

3. Use CLP (Item 9, Appendix D) to clean all armament parts which have been exposed to powder during firing. Parts which require lubrication will be wiped dry and oiled.

4. Do not use coarser material than crocus cloth (Item 10, Appendix D) to remove rust from metal parts. Be careful not to change part size when using crocus cloth. Coat unprotected metal surfaces with oil after cleaning.

5. When installing new parts, remove preservative materials. Lubricate as required.

6. Oil and grease can be removed from canvas, rubber, or plastic items by scrubbing with soap and warm water. Rinse well with clear water and dry.

7. Name plates, caution plates, and instruction plates made of steel may rust very rapidly. If rusty, clean thoroughly and coat with corrosion preventive

8. Clean control and instrument panels, including lenses and bezels with a damp lint-free cloth (item 11, Appendix D).

9. Clean all optical lenses with lens cleaning compound (item 15, Appendix D) and lint-free cloth (Item 11, Appendix D).

10. All lubrication will be performed in accordance with Appendix H.

WARNING

Dry cleaning solvent P-D-680 is toxic and flammable. To avoid injury, wear protective gloves and goggles and use only in a well ventilated area. Avoid contact with skin, eyes, and clothes and don't breathe vapors. Do not use near open fire or excessive heat. The flashpoint for Type I dry cleaning solvent is 100°F (38°C) and for Type II is 140° 'F (60° C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash eyes with water and get medical aid immediately.

11. Use care when cleaning to prevent injury to personnel and damage to equipment.

a. Do not use diesel fuel, oil, gasoline, paint thinner, or benzene (benzol) for cleaning.

b. When using highly volatile cleaning solvents (those that will burn), wear gloves to protect hands from skin-drying effect.

c. Use dry cleaning solvent (Item 38, Appendix D) only in well-ventilated places. A fire extinguisher should be provided nearby.

12. Wash the inside of the tank carefully.

a. Never use high-pressure hoses or steam on the inside of the turret and driver's station, or in the engine compartment when power pack is installed. If the power pack is removed, cleaning of engine compartment must only be done under the supervision of unit maintenance.

b. When inside of tank is really muddy, use a brush and a bucket of soapy water. Rinse with clear water from bucket using sponge. Be sure to open drain valves so water will drain out of hull.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi. Use

only with effective chip-guarding and personal protective equipment

(goggles / face shield, gloves, etc.).

13. The outside of the tank may be cleaned using steam, water, or air under pressure if the following precautions are observed:

a. Engine should be left running during vehicle washing and for a period of 15 minutes after vehicle has been washed to prevent water from entering vehicle air induction system.

b. Open drain valves. If front drain valve is clogged, clean (see 3-209). If rear (engine) drain valves are clogged, release stuck drain valves (see 3-208).

c. Remove drivers periscope wiper blade.

d. Close gunner's primary sight (GPS) ballistic doom (see 2-248).

d.1. Inflate inflatable seal (see 2-117).

e. Close all open hatches, grilles, and access door (see Alphabetical Index).

f. Lock loader's skate mount (see 2-330, step A.).

g. Remove register and install exhaust and intake plugs on personnel heater to keep water from entering heater (see 3-214). Remove plugs and reinstall register after washing tank (see 3-214).

h. Install weapon mounting pins into weapon mounting holes (see Alphabetical Index).

i. Do not direct steam, water, or air under pressure directly into top deck grille and air intake openings. Hydraulic and electrical fining lines could be damaged, Vee packs contaminated, and plenum filled with water.

j. Do not direct steam, water, or air under pressure directly at any periscope seal or turret seal.

K. Do not direct steam or water under pressure directly into rear grille doors. Water may enter engine exhaust system and could damage engine.

l. Do not point steam or water under pressure at road wheel hub caps if within 5 feet (1.5 meters). Water could be forced into the hub and contaminate the oil.

m. Do not direct steam or water under pressure at muzzle reference sensor (MRS). Water may get inside and cause damage.

n. Do not open skirts unless tank is stationary.

n.1. After tank is cleaned, deflate inflatable seal (see 2-117).

14. After tank is cleaned, paint unprotected metal surfaces where necessary in accordance with TM 43-0139.

15. Apply non-slip walkway compound (Item 18, Appendix D) in a matching color to shaded areas as required. Do not apply compound to door grilles, screen hinges, air vents, or other areas not shaded. Apply walkway compound to back of loader's seat (1) as required. Apply phosphate coating (Item 11.1, Appendix D) to support (2) as required.

16. Inspect all external and [illegible]es for corrosion. If corrosion is found, notify ur[illegible]

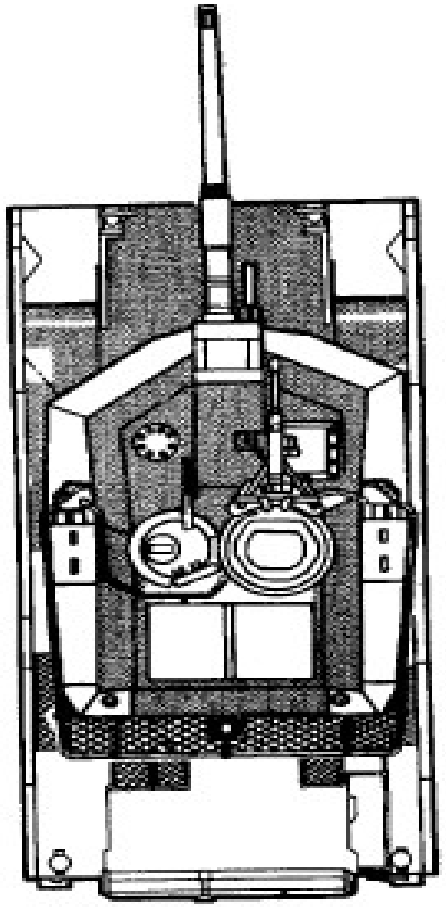


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
1	Before	Vehicle Exterior	DRIVER WARNING Before elevating gun or traversing turret, alert crew and make sure area is clear of obstacles to prevent main gun or turret from hitting personnel. CAUTION If loud, high pitched, squealing noise is heard, or hydraulic pressure drops suddenly to 500 psi, or less, large hydraulic leak is present. Inform tank commander that turret power should be shut off immediately. NOTE Ensure drain valve is open. a. Check for signs of tampering, damage, or missing parts. b. Check for puddles or Large spots of fluids/oil under tank. If fluids/oils are found under the tank, fault isolate to identify the source of the leak.	Class III leak identified.

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
2	Before	Engine Emergency Fire Extinguisher Handle	CREWMEMBER Check that handle has not been pulled out.	Handle pulled out. Handle or cable missing.

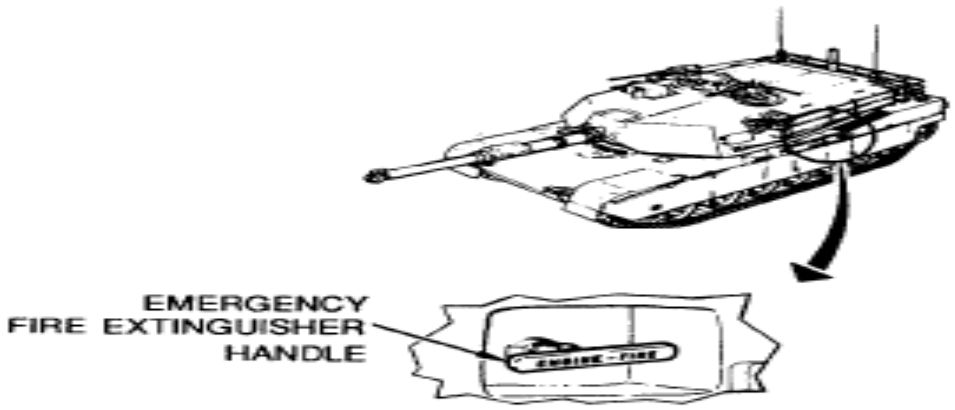


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
3	Before	Quick-Release Pins	DRIVER/CREWMEMBER Check quick-release pins without depressing release button to make sure they do not come out, are locked in place or not damaged on: a. Steering linkage b. Rear service brake linkage c. Left and right parking brake linkages	Any quick-release pin is missing or damaged or will not lock in place.

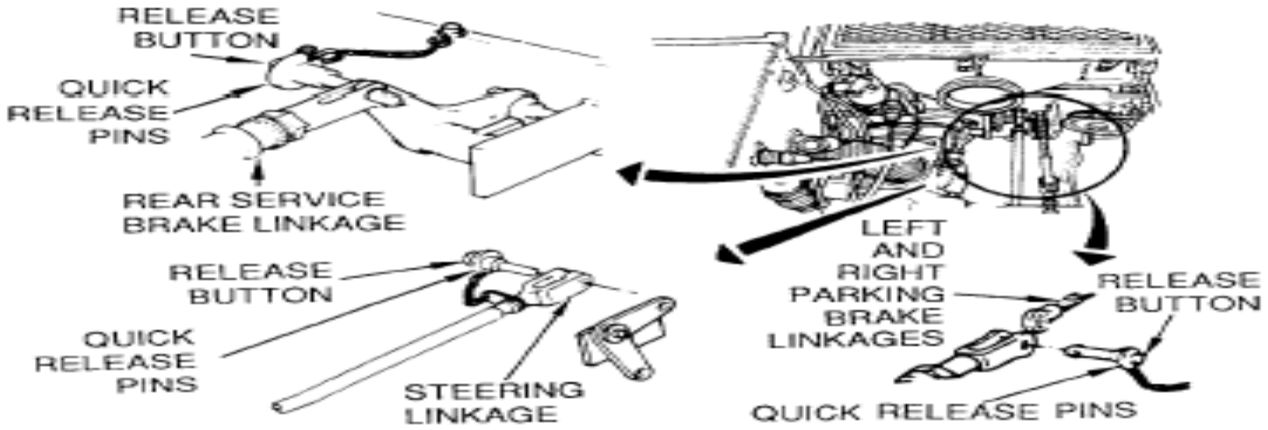


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
			DRIVER	
4	Before	Fire Extinguisher System	Clean sensor lenses in driver's compartment.	Sensor broken, missing or painted over.

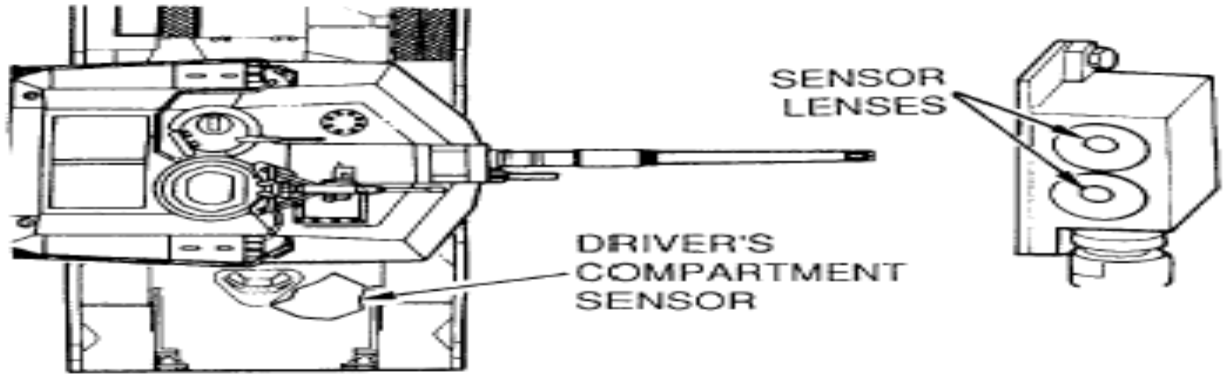


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
5	Before	Driver's Seat	DRIVER a. Make sure that driver's seat can be adjusted. b. Check seat cushions for rips and tears. c. Move headrest and check lock.	Seat missing or inoperative.

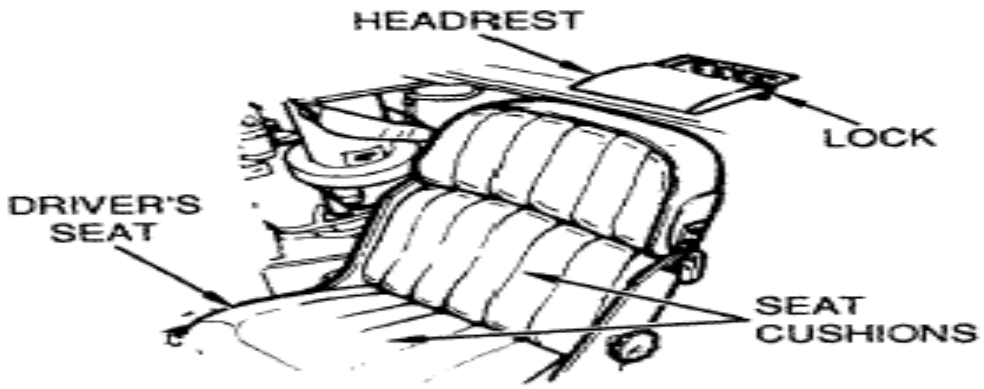


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location: Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
			DRIVER	
6	Before	Driver's Controls	a. Check steer-throttle harness for chafing, kinks or signs of damage and that connectors are tight.	Harness is chafed, kinked or damaged.
			b. Check steer-throttle control for freedom-of-movement.	Steering throttle control binds or does not return to center.
			c. Check throttle grips for freedom-of-movement.	Throttle grips do not return to idle.

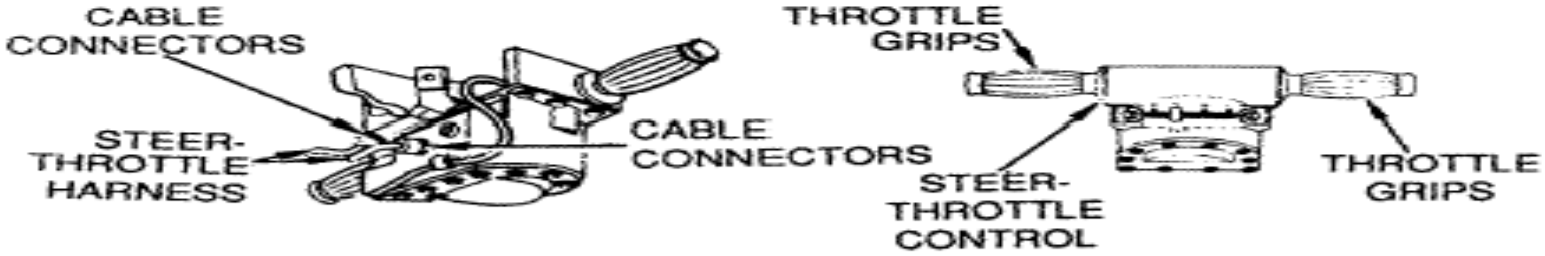


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
7	Before	Gunner's Coaxial Machine-gun 7.62 mm M240	GUNNER **WARNING** Make sure weapon is clear and safe before loading or testing to pre vent accidental filing of machinegun and injury to personnel. a. Check coaxial machinegun for correct mounting. b. Check operation of elec-tric solenoid and manual trigger. Make sure manual safety works properly- Check spent case can for dents or breaks.	Both M240 machineguns missing or unserviceable.

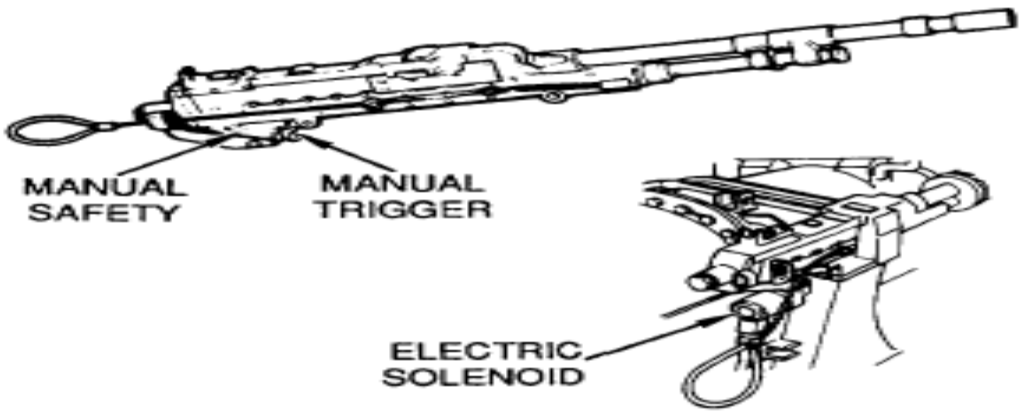


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
9	Before	Crew Compartment Fire Extinguisher Bottles	LOADER/CREWMEMBER NOTE • Bottle pressure should be minimum for ambient temperature at bottle. (See chart on bottle.) • If tank is equipped with marotta valve, gage will be graduated in 75 lb. increments, from 0 lbs. to 1500 lbs. a. Check three fire bottle pressure gages. b. Make sure bottles are secure in mounts by inspecting for damaged support brackets, loose or damaged bottle straps, or missing, loose, chipped, or torn pads. c. Make sure safety pins are not installed in fire extinguisher bottles.	Any fire extinguisher bottle depleted. If any bottle is unsecure in its mount due to a damaged support bracket, loose or damaged bottle strap, or missing, loose, chipped, or torn pad.

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
9.1	Before	Crew Compartment Fire Sensors	LOADER/CREWMEMBER **WARNING** If safety pin is installed in fire extinguisher bottle, fire system will not activate and damage to equipment or injury/ death to personnel may occur. Clean three sensor lenses in turret. If lenses are painted over, notify unit maintenance.	Sensors broken, missing, or painted over.

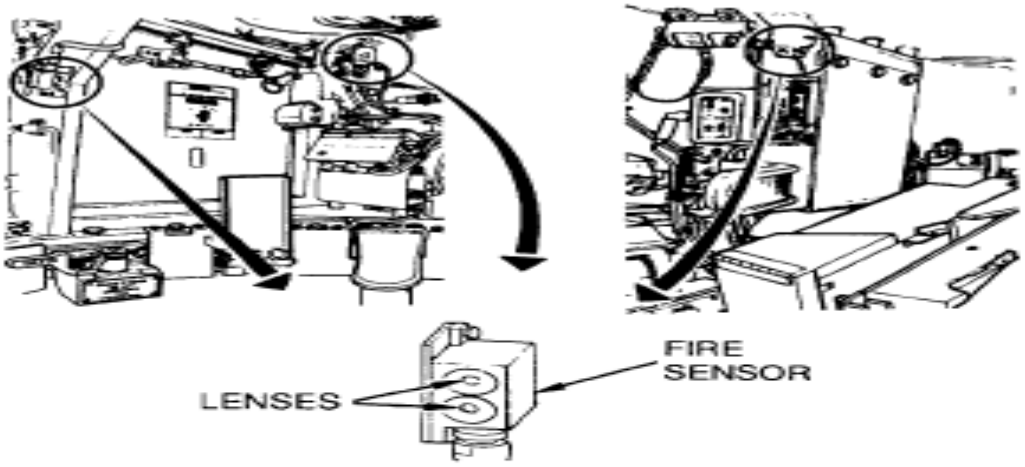


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
10	Before	Machinegun Cal.50 M2	COMMANDER **WARNING** Make sure weapon is clear and safe before loading or testing, to prevent accidental firing of machinegun and injury to personnel. NOTE Clean exterior of optics before doing checks. Check mounting of machinegun in mount. Check headspace and timing (see TM 9-1005-213-10). Check operation of electrical solenoid. Check ammunition stowage in ready box. Boresight machinegun as required.	Machinegun missing or unserviceable.

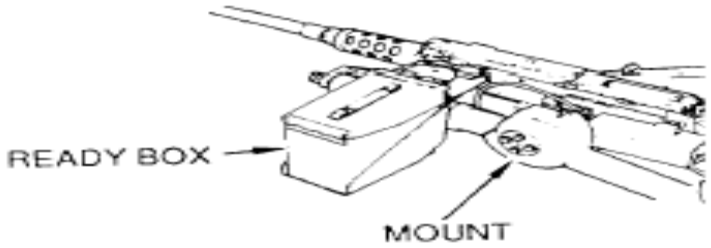


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
			LOADER	
16	Before	Hydraulic System Oil Reservoir	a. Check oil level on reservoir oil level gage. Add oil as necessary.	
		Continued	b. Check for leaks around hydraulic reservoir.	Class III leak is identified.
			c. Check that indicators on hydraulic system oil reservoir are not popped out. If popped out, push indicator in once. NOTE Pressurize system. If either indicator pops out, notify unit maintenance.	

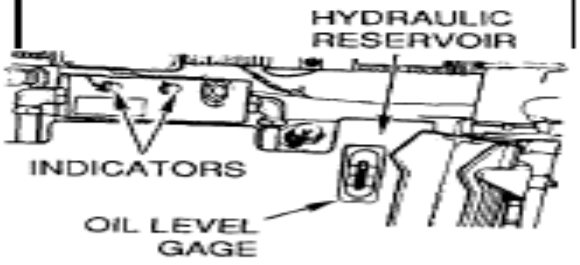


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
18	Before	Engine Start	DRIVER **WARNING** • Do not start engine unless tank commander has clear view of area around tank. Tank commander must warn personnel to stay away from rear of tank and NBC system exhaust area on left side of tank. Personnel can be burned by engine and NBC system exhaust • Make sure steer-throttle control is centered before starting engine. If steer-throttle control is turned left or right tank will pivot when PUSH TO START button is pressed and might injure someone. • Do not leave driver's station after engine is started. Damage to equipment or injury to personnel may occur.	

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
18	Before	Engine Start Continued	DRIVER CAUTION • Stop engine if warning lights remain on. • Make sure that turret is positioned so battery compartment can be opened if starter will not disengage. • If starter fails to disengage after engine is started, disconnect battery negative emergency disconnect link. NOTE Make sure transmission shift control is in "N" position, steer-throttle control is centered and turret power switch in "OFF" position.	

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
36	During	Personnel Heater	DRIVER **WARNING** • Explosive/flammable materials are a fire hazard. Do not store aerosol cans, cleaning solvent, fuel, etc. on or near personnel heater and ducts or anywhere inside tank. Stow ammunition in authorized stowage areas only • If fuel leaks are found, do not use heater. Notify unit maintenance. NOTE • If climatic conditions require the use of a personnel heater, perform the following check: • Set personnel heater temperature to high and fan switch to FAN RUN. Check all tubes and hoses for air and fuel leaks. If leaks are found, notify unit maintenance.	Any fuel leaks found.

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
38	After	Gun/Turret Servo Mechanism Indicators	GUNNER **WARNING** You can be killed if turret is traversed while you are between the turret and driver's station. a. Position main gun over left front fender and lock turret traverse lock. b. Make sure that indicator on traverse servo is not popped out. If popped out, push indicator in once.	

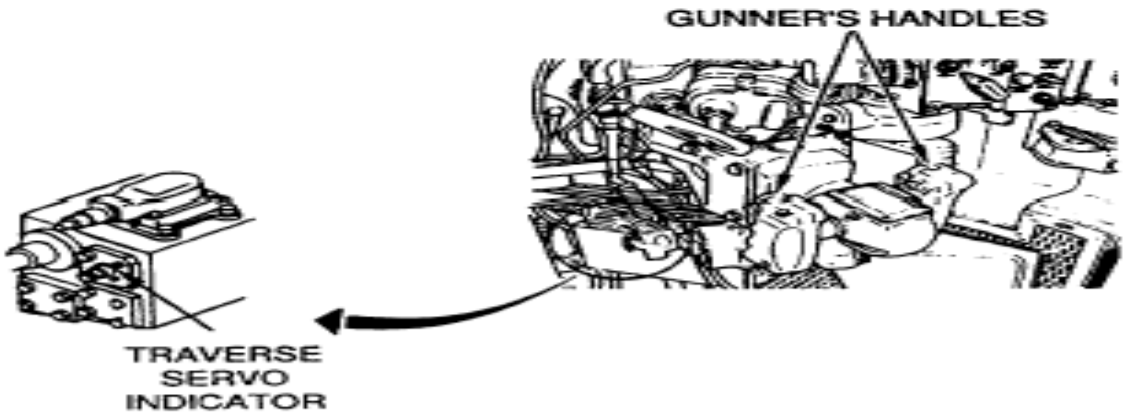


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location: Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
76	After	Torsion Bars	CREWMEMBER To test torsion bars at roadwheel arm positions 2 thru 6, use crow bar to pry up on roadwheels. If roadwheel cannot be lifted, torsion bar is good. If roadwheel can be lifted, the torsion bar may be broken. Notify unit maintenance. At roadwheel arm positions 1 and 7, look for tilt of tank or lifting of roadwheel and track off ground. Tilting of tank or lifted roadwheel/track may be an indicator of a broken torsion bar. Notify unit maintenance.	Any missing or broken torsion bars.

Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
105	Monthly	Engine Exhaust Seal	CREWMEMBER CAUTION Failure to replace damaged or missing exhaust seal may result in damage to equipment or engine compartment. a. Open rear grille doom. NOTE Early configuration exhaust seal is on grille door, late configuration exhaust seal is on exhaust duct. b. Inspect engine exhaust seal for cuts, wear, holes, or burns which go through the seal cover and expose the base material. If damaged, notify unit maintenance. c. Close rear grille doors.	Seal is missing or damaged. Damaged area exceeds 1 inch (2.54cm) and extends past outer edge of grille door imprint.

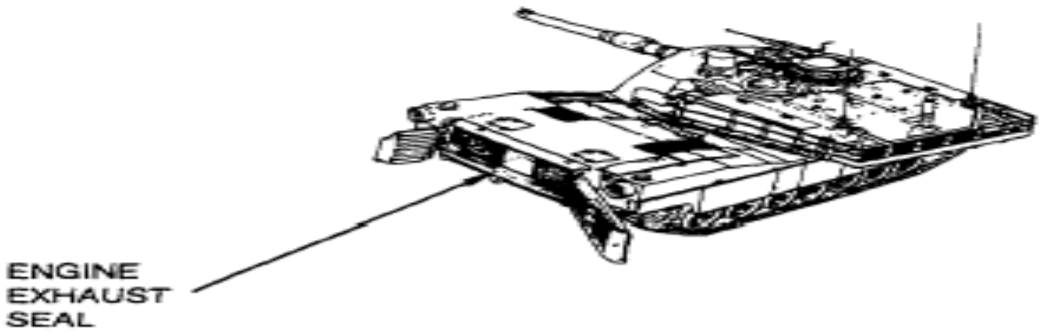
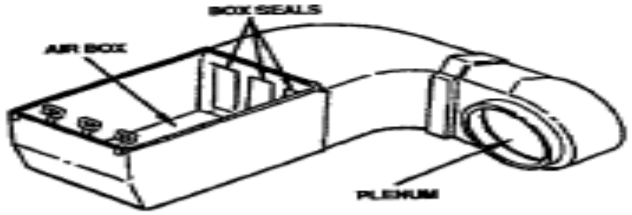


Table 2-1. Preventive Maintenance Checks and Services for Model M1A1

Item No.	Interval	Location Item to Check/ Service	Crewmember Procedure	Not Fully Mission Capable if:
114	Monthly	Air Induction System	CREWMEMBER NOTE Do not take air induction system apart on PJS tank if PJS is operating correctly. Service air induction system (see 3-124.1).	Precleaner-baffle has 10 or more unserviceable tubes. Precleaner-baffle has broken welds or rivets broken or missing. Filter element, precleaner air exhaust hoses, or seals/ gaskets missing or damaged. Air box and plenum has broken welds or cracks. Plenum box seals depression from top surface of seals to bottom of groove is greater than 3/16-inch (4.8 mm).



SECTION III. OPERATION UNDER USUAL CONDITIONS

ALL STATIONS

ENTER TANK THROUGH LOADER'S HATCH

WARNING

If main gun is to the front of tank, climb on tank from left side only to keep from getting in laser or machinegun firing path. Notify driver before climbing on tank if engine is running.

A. Climb on tank using track skirt step (1) and hand hold (2) at left front (3), or using skirt step (1) at right front (4) of hull.

CAUTION

If transponder antenna (4.1) is stepped on, it may break. While climbing on tank, do not step on transponder antenna (4.1).

B. Open loader's hatch (see 2-329).

C. Enter tank through loader's hatch feet first. Step on loader's seat poet, then on turret floor.

OPERATE INTERCOM

NOTE

If your tank has inter-communication control set (1), go to Operate Intercom (C-12357/VRC) (see 2-106.2).

A. Operate amplifier AM 1780/VRC (see 2-400).

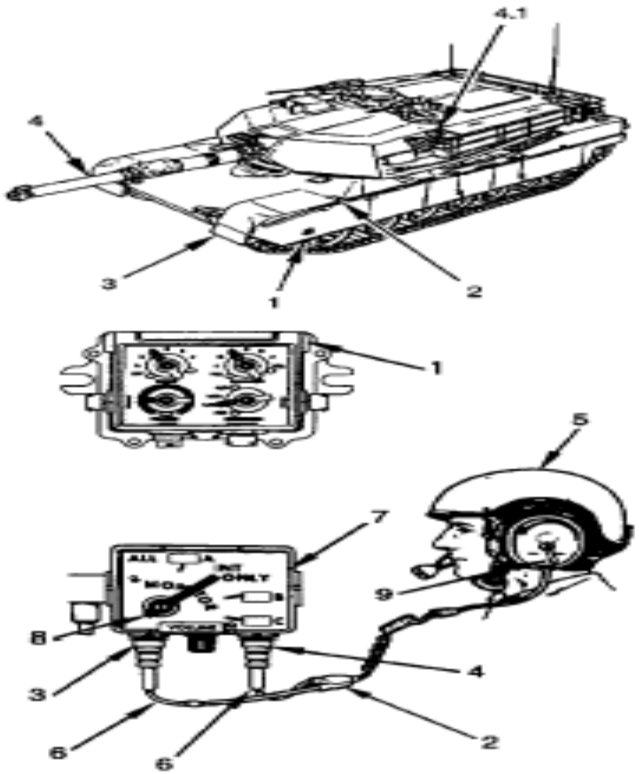
NOTE

If the CVC cord (2) has only one plug, it can be attached to either connector (3) or (4).

B. Put on CVC helmet (5) and connect cables (6) to intercom control box (7) (see 2-402).

C. Set intercom MONITOR switch lever (8) to INT ONLY.

D. Set CVC helmet switch (9) in rear position.



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DRIVER'S
STATION

START ENGINE (START ENGINE - AFTER ABORTED START) - Continued

NOTE

- If voltmeter reads between 23.5 volts and 18 volts, make sure vehicle master power switch is set to off, EAPU started and vehicle batteries charged (see 2-414.1), and auxiliary pump is set to off (see 2-142).
- If EAPU shuts down when output power is set to on, tank must be slave started (see 2-442).

A. Press and hold PUSH TO START pushbutton (5) no longer than 1 second and then let go.

B. If engine does not start, wait 1 minute.

C. Set and hold STARTER ONLY switch (6) to ENGAGED for 20 seconds to 30 seconds and then let go.

D. Wait until engine stops turning and RPM gage (7) shows 0 rpm.

E. Press and hold PUSH TO START pushbutton (5) no longer than 1 second and then let go.

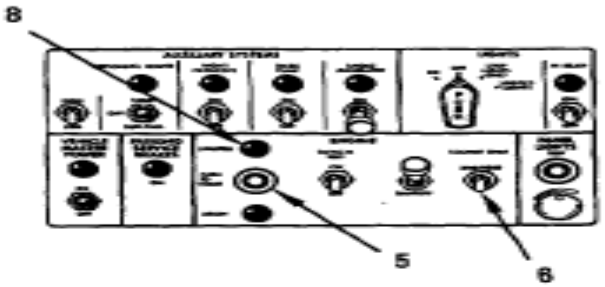
F. If engine does not start, do troubleshooting (see 3-1).

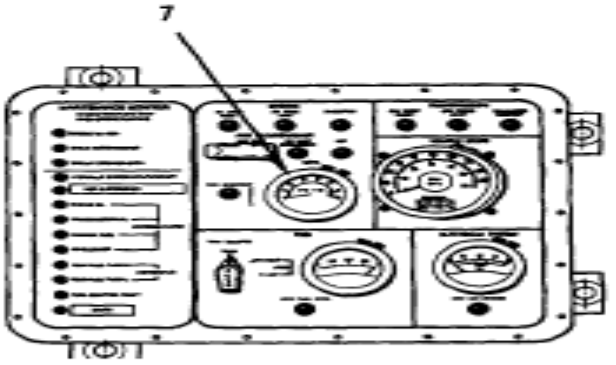
WARNING

If turret networks box circuit breaker CB3 is off, NBC main system cannot be turned on and protection from fumes, smoke, and contamination will be lost. Be sure CB3 is turned on after starting.

G. If turret networks box CB3 was turned off, wait two minutes after STARTED light (8) lights and then have loader set CB3 to ON and reset LAMP RESET pushbutton on turret networks box (see 2-393).

H. Make AFTER-START CHECKS (see 2-13).





GUNNER'S STATION

TEST FIRE CONTROL SYSTEM (PERFORM LEAD SYSTEM CHECK) - Continued

I. Grasp gunner's handles (9) with one hand and hold. Make sure one of palm switches (10) is squeezed.

NOTE

- Releasing palm switches (10) will stop automatic lead until a new range is entered into computer with palm switches (10) depressed.
- Laser rangefinder can be used if desired (see 2-281).

J. Manually enter a 2000 meter range into computer (see 2-256).

K. Look through gunner's primary sight eyepiece (11) and slowly rotate gunner's handles (9) left or right. Reticle will move relative to edge of eyepiece scene as handles (9) are rotated.

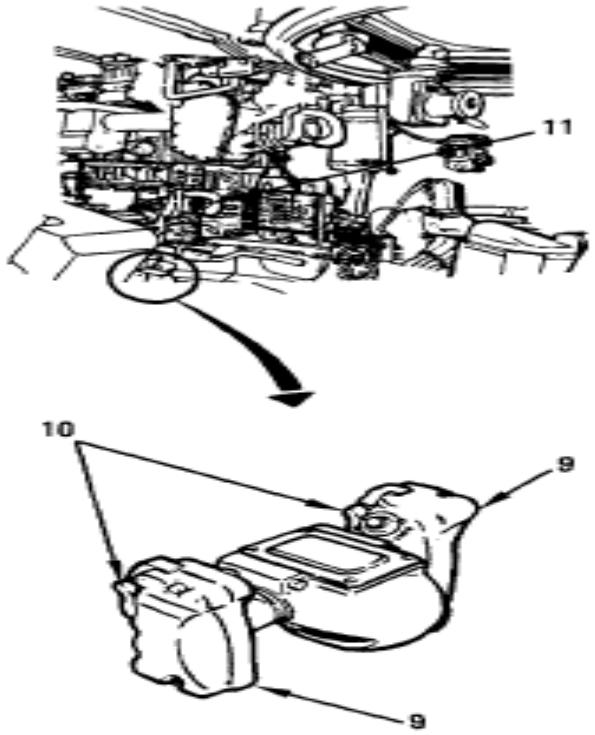
L. Reverse direction of gunner's handles (9). Reticle motion in scene will reverse.

M. Center gunner's handles (9). Reticle will go to center of scene. Lead system operation is checked out.

N. To check operation of counter-rotation function, rotate gunner's handles (9) in one direction, then quickly center gunner's handles (9). You should feel turret motion after gunner's handles are centered.

O. Power down gunner's station (see 2-327).

P. Close GPS left (DAY) ballistic door (see 2-248).



LOADER'S
STATION

OPERATE MAIN GUN 16-ROUND AMMUNITION STOWAGE RACKS (REMOVE 120MM AMMUNITION) - Continued

Ready Ammunition Compartment – Continued

A. Open ready ammunition door manually (see 2-343).

B. To unload tubes 1 thru 16, do procedure for stowage ammunition compartment Steps B thru N (see 2-366.5).

NOTE

- Tube 17 cannot be unloaded until tube 12 is empty.
- Tube 18 cannot be unloaded until tube 16 is empty.

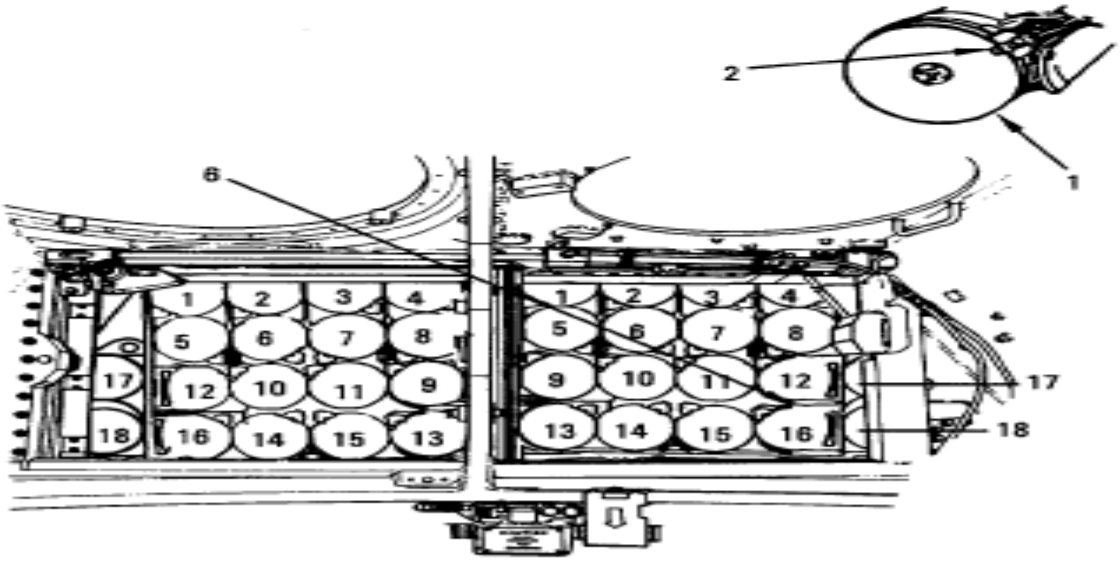
C. Push lever (6) and swing tubes 17 and 18 to the left for unloading.

D. Push spring clip (2) away from round (1) and unload round (1) from tube 17.

E. Push spring clip (2) away from round (1) and unload round (1) from tube 18.

F. Pull lever (6) and swing tubes 17 and 18 back to locked position.

G. Close ready ammunition door manually (see 2-344).



AUXILIARY
EQUIPMENT

START EXTERNAL AUXILIARY POWER UNIT (EAPU) (NORMAL ELECTRICAL START)

NOTE

This procedures uses internal battery to start EAPU (1) and applies only to configurations with internal batteries.

A. Open control panel access door (2). Make sure EAPU (1) switches are set as follows:

1. EAPU START/ON/STOP switch (3) set to STOP.
2. OUTPUT POWER ON/OFF switch (4) set to OFF.
3. CIRCUIT BREAKER ON/OFF switch (5) set to ON.
4. REMOTE/LOCAL switch (6) se to LOCAL.

NOTE

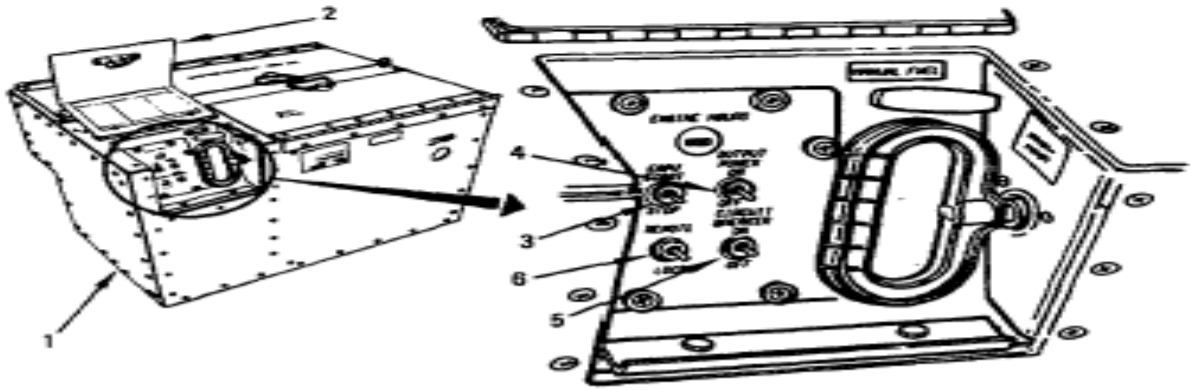
- If EAPU (1) engine does not turn over rapidly using internal battery, go to LOW BATTERY ELECTRICAL START (see 2-414.2).
- In cold weather (below 20°F (-7°C)), engine start will be delayed approximately 1-1/2 minutes while glow plug heats.

B. Move EAPU START/ON/STOP switch (3) to START and release. Engine control unit will begin automatic start cycle.

C. Let EAPU (1) engine run for about 2 minutes. Have driver turn on vehicle master power. Set OUTPUT POWER ON/OFF switch (4) to ON.

D. Close control panel access door (2).

E. When auxiliary power is no longer needed, shut down EAPU (1) (see 2-414.9).



AUXILIARY
EQUIPMENT

OPERATE NUCLEAR, BIOLOGICAL, CHEMICAL (NBC) MAIN SYSTEM - Continued

S. When protective mask (1) is no longer needed, disconnect mask cannister (24) from breakaway air duct socket (13).

T. Disconnect mask mike lead (9) from connector (8).

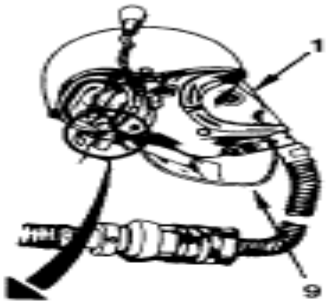
U. Connect mike lead (7) to connector (8).

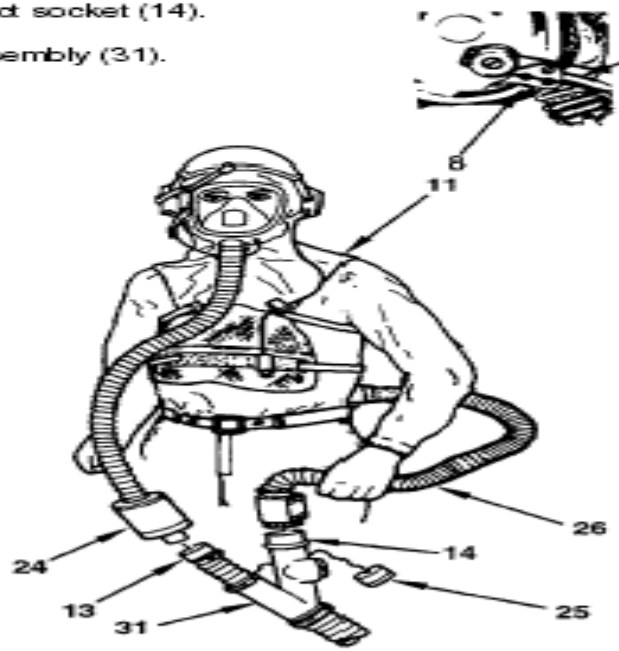
V. Stow protective mask (1) (see Appendix E).

W. When air cooled vest (11) is not needed, disconnect vest air hose (26) from air duct socket (14).

X. Place cap (25) on air duct socket (14).

Y. Stow air duct socket assembly (31).





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AUXILIARY
EQUIPMENT

OPERATE DECONTAMINATING APPARATUS, ABC-M11 (SEE TM 3-4230-204-12&P)

OPERATE DEEP WATER FORDING KIT, NSN 2540-01-300-6502 (SEE TM 9-2540-206-12&P)

OPERATE DETECTOR, CHEMICAL, M43A1 (SEE TM 3-6665-312-12&P)

OPERATE DETECTOR KIT, CHEMICAL AGENT, M256 (SEE TM 3-6665-307-10)

OPERATE MACHINEGUN, 7.62MM, M240 (SEE 2-379, 2-385, 2-469, and TM 9-1005-313-10)

OPERATE MACHINEGUN, CALIBER .50, M2 (SEE 2-202 AND TM 9-1005-213-10)

OPERATE NIGHT VISION VIEWER AN/VVS-2 (V) (SEE 2-167, 2-169, AND TM 11-5855-249-10)

OPERATE PROTECTIVE MASK, M25A1 (SEE TM 3-4240-280-10)

OPERATE RADIO SETS AN/VRC-89E AND AN/VRC-92E (SEE 2-408.1) TM 11-5820-890-10-8

OPERATE RADIOLOGICAL WARNING DEVICE (RADIAC) AN/VDR-2 (SEE TM 11-6665-251-10)

OPERATE SEMI AUTOMATIC RIFLE, M16, 5.56MM (SEE TM 9-1005-249-10)

OPERATE VEHICLE RADIO SET AN/VSQ-2A (SEE 2-186.3) TM 11-5825-283-10)

OPERATOR'S MANUAL, VEHICULAR INTERCOMMUNICATIONS SYSTEM: AN/VIC-3 (SEE TM 11-5830-263-12)

OPERATE SATELLITE SIGNALS NAVIGATION SET AN/PSN-11 (SEE TM 11-5825-291-13)

THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

WEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

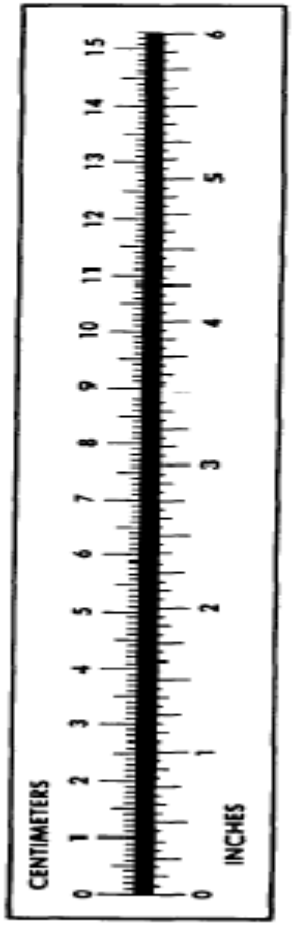
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 = °F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ters	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



Supercedes copies dated 30 December 1985, including all changes; see page i for details.

OPERATOR'S MANUAL

OPERATION UNDER UNUSUAL CONDITIONS, EMERGENCY PROCEDURES, TROUBLESHOOTING, AND MAINTENANCE

VOLUME 2 OF 2

TANK, COMBAT, FULL-TRACKED: 120-MM GUN, M1A1 2350-01-087-1095 GENERAL ABRAMS

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HEADQUARTERS, DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. MARINE CORPS

SEPTEMBER 1990

SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS

UNUSUAL CONDITIONS

GENERAL

A. Special procedures must be used to operate the tank during extreme conditions of temperature, humidity, and terrain. Equipment that is kept clean and lubricated will give the best performance and last longer.
B. If equipment breaks down under extreme conditions, even though correct care has been taken, report failure(s) using SF Form 368 (see 1-3).

OPERATE TANK IN EXTREME COLD (0°F, -18°C to -65°F, -54°C)

WARNING

- Do no touch extremely cold metal (below -65°F, -54°C). Bare skin can freeze to cold metal.
- Wear protective clothing over all exposed skin any time the tank is moved during extreme cold operations. You can get frostbite if skin is exposed.
- If operating with hatches closed, turn main NBC system on for about 5 minutes every hour to prevent carbon monoxide buildup which could kill or injure you.

CAUTION

- Watch panels closely. If any unusual readings occur, stop tank and engine. Check immediately.
- Park in shelter whenever possible. If shelter is not available, park tank so that it faces the wind. Place planks or brush under the tracks so tank will not freeze in place.
- Keep tank covered as much as possible. Use tarpaulins when available to protect the tank. Do not allow ends of tarpaulins to touch the ground. They may freeze in place.
- Fuel filters should be drained before topping off fuel tanks. Keep fuel tanks as full as possible during cold operations. Water forms in an empty fuel tank as it cools. Water in the fuel system could freeze and block the system.
- All snow and ice should be removed from tank as soon as possible. Snow and ice may slow or stop movement of critical parts if allowed to pile up.

The tank must be specially prepared for operating in extremely cold temperatures (0°F, -18°C to -65°F, -54°C). In extreme cold, the fluid in the washer, even with antifreeze added, can freeze; batteries can freeze and crack; oil can get so thick it won't pour; grease gets as stiff as cold butter; and rubber gets so hard it will crack or break easily.

EMERGENCY
PROCEDURES

SERVICE AIR CLEANER

WARNING

After Nuclear, Biological, or Chemical (NBC) exposure of this vehicle, all air filters must be handled with extreme caution. Unprotected personnel may experience injury or death if residual toxic agents or radioactive material is present. If vehicle is exposed to chemical or biological agents, servicing -personnel must wear protective mask hood, protective overgarments, and chemical protective gloves and boots. All contaminated air filters must be placed in double-lined plastic bags and swiftly moved to a segregation area way from the work site. The same procedure applies for radioactive dust contamination; however, the company NBC team should measure the radiation prior to filter removal to determine extent of safety procedures required in accordance with the NBC Annex to unit Standing Operating Procedures (SOP). The segregation area in which the contaminated air filters are temporarily stored must be marked with appropriate NBC placards. Final disposal of contaminated air filters shall be in accordance with local SOP.

CAUTION

This procedure should only be used when the crew cannot return to a unit maintenance site to get air filter elements cleaned or do not have another tank available to use cleaning wand procedure (see 2-475). Use extreme care when handling air filter elements to prevent damaging seals or puncturing or denting air filter elements. Engine damage can occur when dust or dirt enters the engine around improperly fitted or damaged air filter elements.

NOTE

If you are doing this procedure because AIR CLEANER CLOGGED FILTER light is lit, make sure troubleshooting has been performed for AIR CLEANER CLOGGED FILTER LIGHT LIT (see 3-1).

A. Open grille doors and covers (see 3-124).

B. Remove any foreign material that may have caused a blockage.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

SECTION I. LUBRICATION

SERVICE INTERVALS - NORMAL CONDITIONS

For safer, more trouble-free operation, make sure that your tank is serviced when it needs it. For the proper lubrication and service intervals, see Appendix H.

SERVICE INTERVALS - UNUSUAL CONDITIONS

Your tank will require extra service and care when you operate under unusual conditions. High or low temperatures, long periods of hard use, or continued use in sand, water, mud, or snow will break down the lubricant, requiring you to add or change lubricant more often.

SECTION II. TROUBLESHOOTING

SYMPTOM (MALFUNCTION) INDEX

The symptom (malfunction) index on page 3-2 is a quick-reference for finding troubleshooting procedures. The index will refer you to a page in the troubleshooting table or tell what action to perform.

TROUBLESHOOTING TABLE

1. The troubleshooting table beginning on page 3-14 lists the malfunctions, tests, or inspections and corrective actions required to return the tank to normal operation.

2. This manual cannot list all malfunctions that may occur, or all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify unit maintenance.

3. When instructions to lubricate, grease, or oil appear in the troubleshooting table, refer to Appendix H.

TROUBLESHOOTING

SYMPTOM (MALFUNCTION) INDEX

SYMPTOM (MALFUNCTION)	Troubleshooting Procedure	Page
DRIVER'S WARNING AND CAUTION LIGHTS		
MASTER WARNING Light Lit, No Other Warning (Red) Lights Lit	1.	3-14
MASTER WARNING Light Does Not Come On When A Red Warning Light Comes On	2.	3-14
MASTER CAUTION Light Lit, No Other Caution (Yellow) Lights Lit	3.	3-15
MASTER CAUTION Light Not Lit When Any Other Caution Light Is Lit	4.	3-15
ENGINE FIRE Light Lit	See 2-146 steps A. and B.	
ENGINE OIL CLOGGED FILTER Light Comes On	*	
ENGINE OIL TEMP HIGH Light And MASTER WARNING Light Come On	5.	3-15
ENGINE OIL PRESS LOW Light Lit	6.	3-16
ENGINE OIL LOW Light Lit	7.	3-17
ENGINE OVERSPEED Light Lit	See 2-147, step D.	
GAS OVERTEMP Light Lit	No action required	
TRANSMISSION OIL CLOGGED FILTER Light Lit and TRANSMISSION OIL TEMP HIGH Light or TRANSMISSION OIL PRESS LOW Light Lit	See 2-151, step I.	
TRANSMISSION OIL CLOGGED FILTER Light Lit	See 2-151, step I.	
TRANSMISSION OIL PRESS LOW Light Lit	8.	3-17
TRANSMISSION OIL TEMP HIGH Light Lit	9.	3-18
TRANSMISSION DAMAGED - INSPECT Light Lit	See 2-150, step H.	

*Notify unit maintenance

MAINTAIN PRECLEANER (SERVICE AIR INDUCTION SYSTEM) - Continued

C. Inspect precleaner-baffle (6) for broken welds or rivets and broken or missing latches (7). If damaged, notify unit maintenance.

D. Inspect intake filter element (8) with flashlight for damage. If damaged, notify unit maintenance.

E. Inspect precleaner-baffle upper seals (9,10) and bottom gasket (11) for damage. If damaged, notify unit maintenance.

NOTE

Tank is still mission capable if handles (12) are damaged or broken.

F. Inspect handles (12) for damage or broken welds. If damaged, notify unit maintenance.

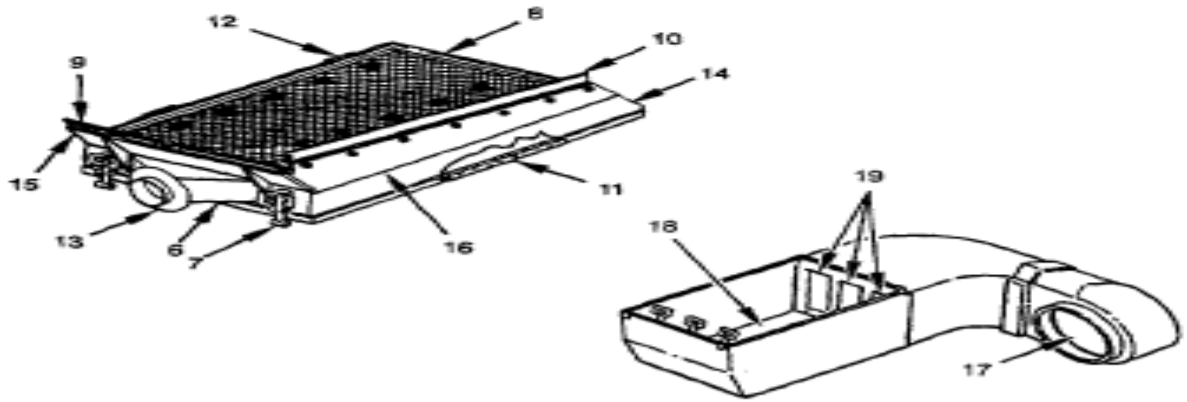
G. Inspect scavenge exhaust opening flange (13), box (14), rear baffle (15), and side baffle (16) for damage or holes. If damaged, notify unit maintenance.

H. Clean inside of plenum (17) and air box (18) with damp rag (item 36, Appendix D).

I. Check plenum (17) and air box (18) for broken welds or cracks. If damaged, notify unit maintenance.

J. Inspect three plenum box seals (19) for tears, cracks, deterioration, or permanent seal set. Measure seal set depression from top surface of seals to bottom groove. If greater than 3/16-inch (4.8mm) or if torn, cracked, or deteriorated, notify unit maintenance.

K. Install air filter elements (see 2-483, steps Z. thru AO.).



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CHAPTER 4

MAINTENANCE OF AUXILIARY EQUIPMENT

Information on maintenance of the auxiliary equipment listed is provided in the following technical manuals:

Antenna, AS-1729/VRC	TM 11-5985-262-15
Antenna, AS-2731/GRC	TM 11-5985-355-13
Control, Frequency Selector, C-2742/VRC	TM 11-5820-401-12
Decontaminating Apparatus, Portable, DS2, 1-1/2 Quart, ABC-M11	TM 3-4230-204-12&P
Detector Kit, Chemical Agent, M256	TM 3-6665-307-10
Detector, Chemical, M43A1	TM 3-6665-312-12&P
Digital Computer Set, AN/UYK-128	TM 11-7010-326-10 ■
Intercom Set, Amplifier, AM 1780/VRC Control Intercommunication Set, C-10456/VRC	TM 11-5830-340-12
Machinegun, 7.62mm, M240	TM 9-1005-313-10
Machinegun, Caliber .50, M2	TM 9-1005-213-10
Mask, Protective, Tank, M25A1	TM 3-4240-280-10
Operator's and Unit Maintenance Manual (Deep Water Fording Kit)	TM 9-2540-206-12&P
Operator/Maintenance Information On Cartridge, 120MM:	TB 9-2350-320-14
Radio Set, AN/VRC-64: Amplifier, OA-3633/ GRC Receiver-Transmitter, RT 841/PRC-77 and AN/VRC-64	TM 11-5820-498-12

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CHAPTER 5

AMMUNITION

SECTION I. INFORMATION

120MM AMMUNITION

WARNING

Use of unauthorized ammunition for the 120mm gun M256 may result in death or injury to personnel.

Ammunition for the 120mm gun M256 may be interchanged with authorized Federal Republic of Germany produced 120mm tank gun ammunition. It is fixed ammunition - ready to fire. It uses a combustible side wall cartridge case with a metallic stub base. All but the stub base and primer are consumed when the round is fired. The HEAT-MP-T and APFSDS-T complete rounds (1) consist of an electric primer (2), a propelling charge (3) inside the combustible cartridge case (4), and a projectile (5). One HEAT-MP-T round has an explosive shaped charge assembled with a point initiating base detonating fuze (6). For cartridge, M830A1, the projectile (5) consists of a subcaliber projectile (7) and a three piece aluminum sabot (8). The subcaliber projectile (7) combines a fuzing system and chemical energy warhead (Composition A3, Type II). The three piece sabot (8) is secured to the warhead body. The fuzing system includes: M774 Base Element (9) flexible communication circuit, frontal impact switch assembly, and M74 Proximity Switch (10). The APFSDS-T round has a heavy metal penetrator (11) and discarding sabot (12). The combustible cartridge case (4) is secured to the projectile (5) and to the metallic case base (13).

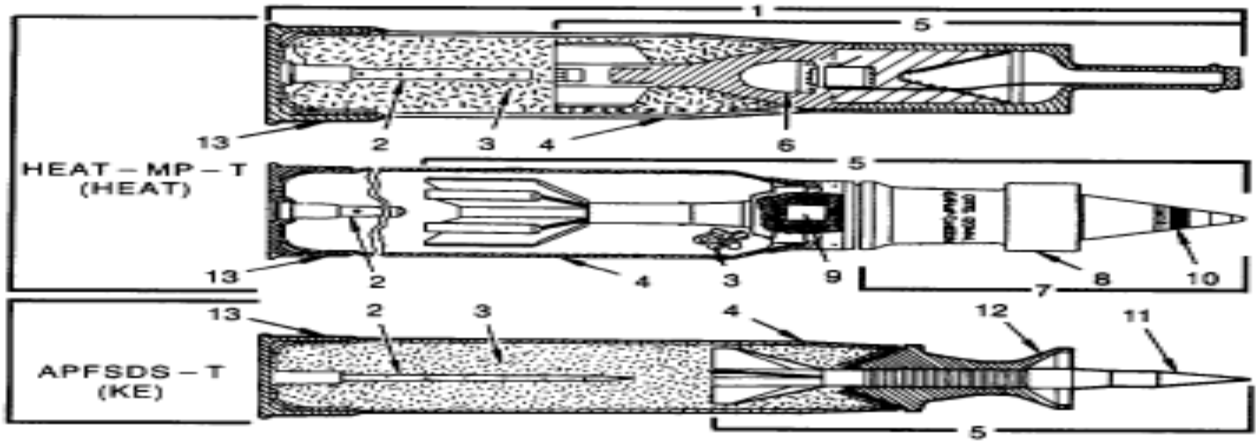


Table 5-2. Ammunition Serviceability Criteria - Continued

Component/ Assembly	Damage	Disposition
Rubber seal (4) (M865)	a) Partially torn or gouged	OK to fire.
	b) Split	Do not fire. Turn in.
Forward bore riding surface (5)	Gouged or burred	Do not fire. Turn in.
Projectile (6)	a) Projectile (6) moves/rattles within sabot	OK to fire.
	b) Moisture contamination: visible water marks (a transition line from a light colored area to a dark colored area)	Do not fire. Turn in.
Tip and windshield (M829, M829A1, and M829A2)	a) Bent tip	Do not fire. Turn in.
	b) Cracked or loose windshield	Do not fire. Turn in.
Combustible case (7)	a) Side wall of case (7) containing scratches which resemble pinstripes, exposing combustible case material (yellowish-white), no more than six scratches per case (7)	OK to fire.
	b) Combustible case material (yellowish-white) visible on case shoulder (scratches and/or spots)	Do not fire. Turn in.
	c) Side wall of case (7) revealing bands or areas of combustible case material (yellowish-white)	Do not fire. Turn in.

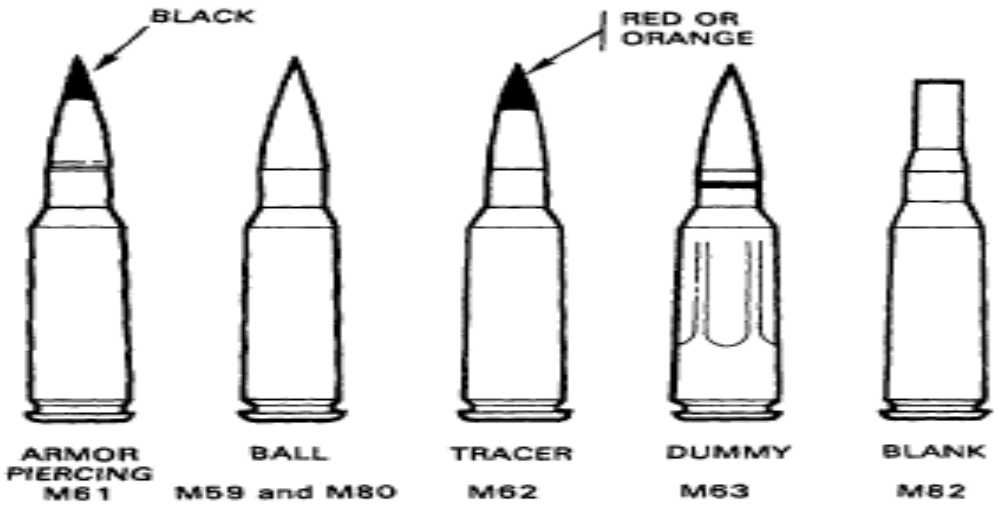
7.62MM AMMUNITION

NOTE

The only types of ammo authorized for use in your M240 machinegun are listed in this TM. If it is NOT shown, it is NOT AUTHORIZED.

7.62mm machinegun ammunition is supplied as a complete round with open loop metal links (M13). Using these metal links, belts of various lengths may be assembled. The following ammunition types are authorized for the 7.62mm machinegun.

NATO 7.62-MM AMMO



NOTE

Ammo which fails to fire in your weapon will be separated from other ammo and reported to authorized personnel.

Normal training mix consists of four ball M59 or M80 with one tracer M62 (1305-A151) (Red tipped tracer).
Normal combat mix consists of four ball M59 or M80 with one tracer M62 (1305-A131) (Orange tipped tracer).

APPENDIX A

REFERENCES

A-1. SCOPE

This Appendix lists all forms, field manuals, technical manuals, and miscellaneous publications referenced in this manual except the publications for maintenance of auxiliary equipment. Publications for maintenance of auxiliary equipment are listed in chapter 4.

A-2. FORMS

DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2028-2	Recommended Changes to Equipment Technical Publications
DA Form 2062	Hand Receipt
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2408	Equipment Log Assembly (Records)
DA Form 2408-4	Weapon Record Data
DA Form 2408-9	Equipment Control Record
DA Form 2408-14	Uncorrected Fault Record
DA Form 2408-20	Oil Analysis Log
DD 518	Accident Identification Card
SF 91	Motor Vehicle Accident Report
SF 368	Product Quality Deficiency Report

A-3. FIELD MANUALS

FM 3-3	NBC Reconnaissance and Decontamination Operations
FM 3-5	NBC Decontamination
FM 9-207	Operation and Maintenance of Ordnance Materiel in Cold Weather
FM 17-12-1	Tank Gunner
FM 20-22	Vehicle Recovery Operations
FM 21-11	First Aid For Soldiers
FM 21-40	Nuclear Biological Chemical (NBC) Defense
FM 31-70	Basic Cold Weather Manual
FM 31-71	Northern Operations
FM 90-3	Desert Operations
FM 90-6	Mountain Operations

APPENDIX B
COMPONENTS OF END ITEM
AND BASIC ISSUE ITEMS LISTS

SECTION I. INTRODUCTION

B-1. SCOPE

This appendix lists components of end item and basic issue items for the M1A1 tank to help you inventory items required for safe and efficient operation.

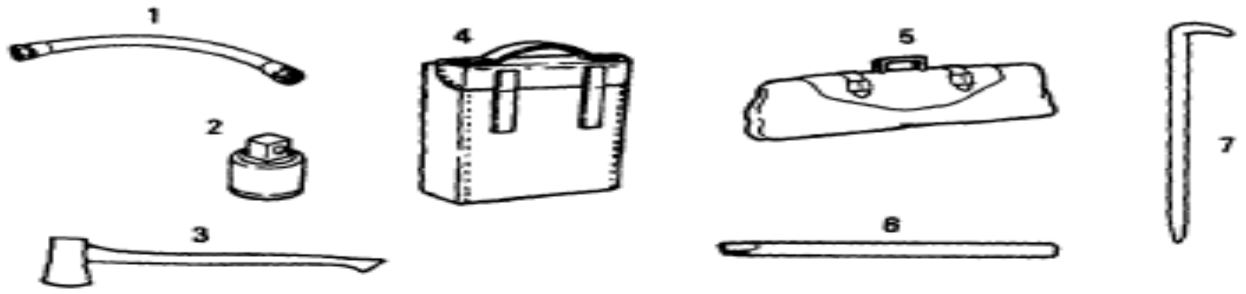
B-2. GENERAL

The Components of End Item and Basic Issue Items Lists are divided into the following sections:

a. SECTION II. COMPONENTS OF END ITEM. This listing is divided into SPARE/REPAIR PARTS and ON-BOARD SPARES subsections. The SPARE/REPAIR PARTS subsection is for informational purposes only, and is not authority to requisition replacements. These components are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these components must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items. The ON-BOARD SPARES subsection is for authorization of the items in this subsection. These are mission items which accompany the end item whenever it is issued or operated. They are not illustrated.

b. SECTION III. BASIC ISSUE ITEMS. These are the minimum essential items required to place the M1A tank in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, Basic Issue Items (BII) must be with the M1A1 tank during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII based on TOE/MTOE authorization of the end item.

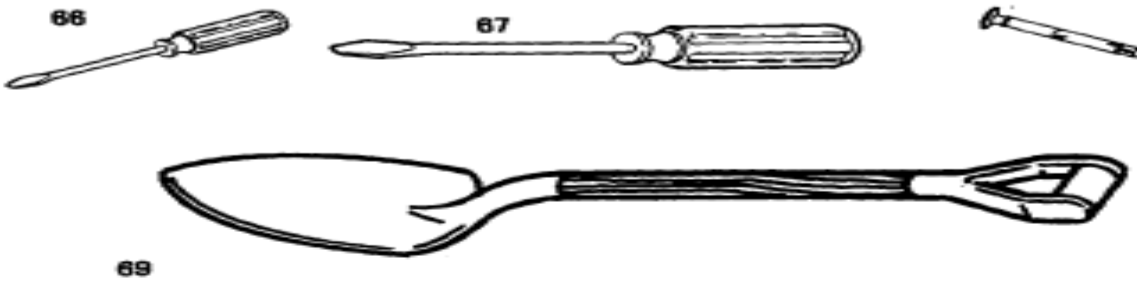
SECTION III. BASIC ISSUE ITEMS



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGE & PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
1	4930-00-288-1511	Adapter, grease gun: (tool bag)(81349) MILL4387		EA	1
2	5120-00-227-8088	Adapter, socket wrench, 3/4-inch drive to 1/2-inch drive: (in tool bag)(8Z799) SH-131		EA	1
3	5110-00-293-2336	Ax, single bit, 4-lb: (in right sponson box) (19207) 6150925		EA	1
4	2540-00-670-2459	Bag Assembly, pamphlet: (under commanders platform) (19207) 11676920		EA	1*
5	5140-00-473-6256	Bag, tool, satchel: (in left cargo rack box)(34623) 11655979		EA	1
6	5120-00-526-6044	Bar, pinch: (in tool bag) (19204) 5266044		EA	1
7	5120-00-224-1389	Bar, pry: (in tool bag) (93389) 2126		EA	1

*Indicates Basic Issue Items that are located inside the vehicle during shipment.

BASIC ISSUE
ITEMS



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGE & PART NUMBER	USABLE ON CODE	(4) U/M	(5) QTY RQR
66	5120-00-227-7356	Screwdriver, flat tip 3/16-inch wide x 6-inch long: (in tool bag)(64067) 5120-00-227-7356		EA	1
67	5120-00-517-6906	Screwdriver, flat tip, 5/16-inch wide x 4-inch long (in tool bag)(81348) GGG-S-121		EA	1
68	5120-00-180-0729	Screwdriver, jeweler: (in tool bag)(81348) GGG-S-1808		EA	1
69	5120-00-224-9326	Shovel, hand, round point (in right sponson box) (81348) GGG-S-326		EA	1

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APPENDIX C
ADDITIONAL AUTHORIZATION LIST

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists additional items you are authorized for the support of the M1A1 tank.

C-2. GENERAL

This list identifies items that do not have to accompany the M1A1 tank and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

C-3. EXPLANATION OF COLUMNS

Below is an explanation of columns found in the tabular listings:

a. Column (1) - NATIONAL STOCK NUMBER. Indicates the National Stock Number assigned to the item and will be used for requisitioning purposes.

b. Column (2) - DESCRIPTION. Indicates the item name listed in alphabetical sequence under the type document (i.e., CTA, MTOE, TDA, or JTA} which authorizes the item(s) to you. The entry for each item ends with the Commercial and Government Entity Code (CAGE) in parentheses followed by the part number.

c. Column (3) - U/M (Unit of Measure). Indicates the measure used in support of this equipment. This measure is expressed by an alphabetical abbreviation (e.g., EA, PR).

d. Column (4) - QTY AUTH (Quantity Authorized). Indicates the quantity of the item authorized to be used with the equipment.

SECTION II. ADDITIONAL AUTHORIZATION LIST

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION CAGE & PART NUMBER	USABLE ON CODE	(3) U/M	(4) QTY AUTH
	MTOE AUTHORIZED ITEMS			
6665-01-105-5623	Alarm, chemical agent automatic, manpack M8: (81361) C5-15-8800		EA	1
1240-01-207-5787	Binocular: (19200) 12599242		EA	1
2590-00-148-7961	Cable Kit, special purpose (slave cable): (56161) 10502786		EA	1
6145-01-155-4258	Cable, telephone: (0063) WD1A-.5 KILOMETER		FT	3
1055-00-000-0138	Launcher, grenade, smoke RPM250: (81361) C13-12-122 Consisting of: Cover, protective 1040-01-042-3861 Left Hand: (81361) 13-12-39 1040-01-043-7896 Right Hand: (81361) 13-12-38 Discharger, smoke grenade No. 19 MK 1040-01-041-9828 Left Hand: (K6897) FV855991 1040-01-041-9829 Right Hand: (K6897) FV855990		EA	1
1005-01-025-8095	Machinegun, 7.62mm, M240: (19200) 11826290		EA	2
1005-00-957-3893	Machinegun, caliber .50, M2: (19200) 5910630		EA	1
1290-00-891-9999	Quadrant, fire control: (19200) 7197156		EA	1

APPENDIX F
GUNNERY CHECKS AND PROCEDURES

GENERAL

This appendix describes the tasks to be performed to ensure accurate sight adjustment and fire control accuracy.

Equipment needed to perform these checks is as follows:

1. Gunner's quadrant
2. Muzzle boresight device

   or

   binoculars, black thread, and tape

NOTE

- Prior to performing armament accuracy checks, perform PMCS (see 2-32).
- The following armament accuracy check tasks must be done in the order given within this procedure with a minimum of delay between tasks.

PERFORM ARMAMENT ACCURACY CHECK 1 (MAIN ACCUMULATOR PRESSURE CHECK)

A. Bleed air from turret traverse hydraulics (see 3-137).

B. Perform hydraulic zero pressure check (see 2-267).

C. Check hydraulic system oil reservoir (see 2-56).

APPENDIX H
LUBRICATION INSTRUCTIONS

H-1. SCOPE.

This appendix provides crew lubrication instructions. Lubrication intervals (on-condition or hard time) are based on normal operation. Lubricate more often during constant use or in severe conditions.

H-2. GENERAL.

All lubrication instructions are mandatory.

Use only authorized lubricants.

Interval symbols used are as follows: B - Before Operation, A - After Operation, AR - As Required, and M - Monthly.

For equipment under manufacturer's warranty, hard time service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or equipment is operated under adverse conditions.

Engine, transmission, and hydraulic system fluid levels are checked according to this appendix, but drain and refill are subject to Army Oil Analysis Program (AOAP). Oil samples must be submitted by unit maintenance as follows: engine oil after 25 hours of engine operation or 60 days; transmission oil after 75 hours of engine operation or 90 days; hydraulic system oil annually. If AOAP is not available, hard time intervals apply.

Hard (fixed) time intervals and the related man-hour times are based on normal operation. The man-hours time specified is the time you need to do all the services prescribed for a particular interval. Change the interval if your lubricants are contaminated or if you are operating the equipment under adverse conditions, including longer-than-usual operating hours. The interval may be extended during periods of low activity. If extended, adequate preservation precautions must be taken.

If operating in 0°F to -65°F (-18°C to -54°C) temperatures without Army Oil Analysis, semiannual/750 mile transmission and engine oil changes are required.

When checking fluid levels, vehicle must be on level surface.

Dispose of used lubricants in accordance with local Standing Operating Procedures (SOP).

For arctic operation, see FM 9-207.

For desert operation, see FM 90-3.

If no other treatment is directed, paint or coat unprotected metal surfaces with oil (P-S) or (PL-M)(Item 30 or Item 32, Appendix D).

Clean around filler necks/drain plugs/openings before servicing to keep dirt from entering system.

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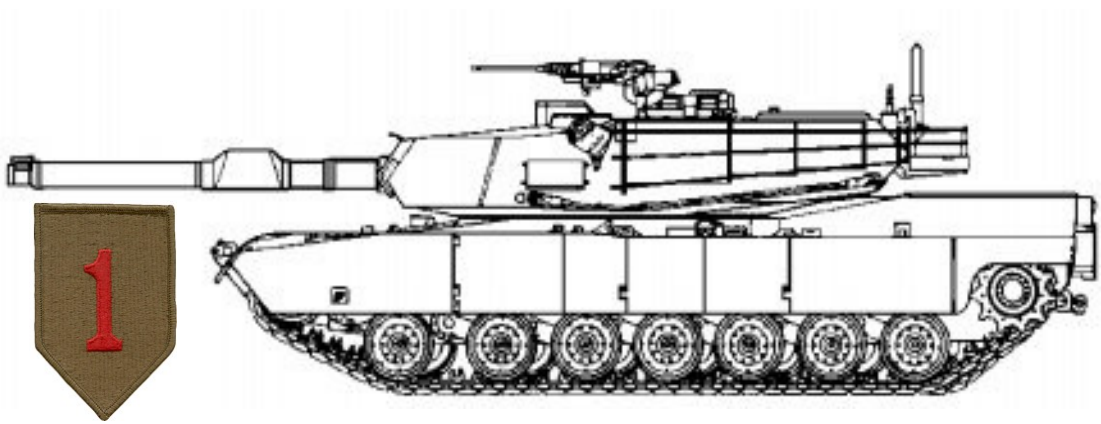
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